UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/628,400	07/29/2003	Norihiko Nadanami	Q76680	3989

23373 7590 12/26/2006

SUGHRUE MION, PLLC
2100 PENNSYLVANIA AVENUE, N.W.
SUITE 800
WASHINGTON, DC 20037

EXAMINER	
OLSEN, KAJ K	
ART UNIT	**PAPER NUMBER**
1753	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/26/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/628,400	NADANAMI ET AL.	
	Examiner	Art Unit	
	Kaj K. Olsen	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 25-30 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 25-30 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 7-29-03;6-25-04.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: Page 1 of the specification should be amended to reflect that application 09/716,225 has matured into patent 6,652,723.

Appropriate correction is required.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 25-30 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 3, 4, 9-11, 13, 14, 19, and 20 of U.S. Patent No.

6,652,723. Although the conflicting claims are not identical, they are not patentably distinct from each other.

4. Claim 25 of the instant invention substantially reads on claims 1, 3, and 9 of the patent. In particular, claim 25 differs from claim 1 of the patent in (a) specifying that the electrodes are on opposite surfaces of the electrodes, (b) specifying that the opening diameter of the through-hole is 1 μm or higher, and (c) not specifying the various limitations about the diffusion resistance of the diffusion limiting portion. With respect to (a) and (b), these limitations can be found in claim 3 and 9 respectively of the patent. With respect to (c), claim 25 fully encompasses the diffusion limitations of claim 1 of the patent.

5. With respect to claim 26, see claim 10 of the patent.

6. With respect to claims 27 and 28, see claims 11, 13, 19, and 20 of the patent and the analysis for claim 25 above.

7. With respect to claims 29 and 30, these are substantially similar to claims 25 and 27 respectively discussed above only further including the limitations of claims 4 and 14 from the patent.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nadanami et al (USP 6,337,009) in view of either JP 8-327,592 (hereafter "JP '592") or JP 63-094,146 (hereafter "JP '146") with or without evidence from Logothetis et al (ACS Symposium Series 309, pp. 136-194, 1986).

10. Although this reference does not have a US filing date that predates all foreign applications, applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

11. With respect to claim 25, Nadanami discloses a hydrogen gas sensor comprising a proton-conductive layer 5 formed of a polymer electrolyte, first and second electrodes (3, 4) disposed on surfaces of the electrolyte, a diffusion-rate limiting portion (2, 22) disposed between the first electrode and the atmosphere of gas under measurement, a circuit (6, 7) for applying a voltage between the first and second electrodes such that hydrogen introduced from the atmosphere via the diffusion-rate limiting portion undergoes dissociation to produce protons on the first electrode to the second electrode via the proton-conductive layer. See fig. 1 and 4, col. 3, ll. 45-48, col. 5, ll. 43-45, and col. 5, l. 66 through col. 6, l. 33. With respect to diffusion-rate limiting portion comprising a dense body having a through hole of 1 μm or higher, fig. 4 shows an embodiment where a hole is placed in a dense body 21. Because the particles utilized to construct element 22 are on the order of tens of microns clearly indicates that the hole that Nadanami places these porous particles is clearly greater than 1 or 30 μm. With respect to said sensor having a proton-conducting rate from the first electrode to the second electrode that is greater than a rate at which protons derived from hydrogen are introduced onto the electrode, that

is inherent in diffusion limiting devices like Nadanami. In particular, layer 2 and 22 of Nadanami is referred to as a diffusion-rate limiting layer because its function is to limit the diffusion of gas to be sensed to the sensing electrode. This is further evidenced by Logothetis, which teaches that diffusion limited sensors have a complete depletion of gas at the surface of the sensing electrode. See the paragraph bridging pp. 141 and 143. The reason that the gas is completely depleted at the sensing electrode surface is because the rate of sensing gas flow to the sensing electrode is less than the ability of the sensor to transmit the dissociated gas through the electrolyte. In other words, the rate at which sensing gas ions can transmit from the first electrode to the second electrode is greater than the rate at which gas can be made available to the sensing electrode.

12. Nadanami does not explicitly disclose disposing the first and second electrodes on opposite surfaces of the proton electrolyte. However, that is a conventional arrangement for the electrodes in the hydrogen gas sensor art. In particular, both JP '592 and JP '146 teach placing the first and second electrodes on opposite surfaces of the electrolyte. See JP '592, fig. 5, 6, and 8 and see JP '146, fig. 1 and 4. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of JP '592 or JP '146 for the sensor of Nadanami because the substitution of one known electrode arrangement for another requires only routine skill in the art. In addition, such an arrangement of electrodes as provided by JP '592 and JP '146 would provide a higher surface area for discharging the water vapor released by the second electrode. Nadanami only has a small portion of its second electrode exposed for releasing discharged gas.

13. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '146 in view of Yamazoe et al (USP 4,718,991) with or without evidence from Logothetis.

14. JP '146 discloses a hydrogen gas sensor comprising a proton-conductive layer 1 having first and second electrodes (2, 3) disposed on opposite surfaces such that the first and second electrodes sandwich the proton-conductive layer. JP '146 further discloses the use of a diffusion-rate limiting layer 5 comprising a dense body having a through-hole 4. See fig. 4. The specification defines this hole as being a "micropore" (by USPTO translator). The examiner will interpret this term as being drawn to micrometer scaled holes and will interpret this term as reading on a hole having a diameter of at least 1 μm. JP '146 further discloses a circuit for applying voltage between the first and second electrodes such that hydrogen introduced from the atmosphere via the diffusion limiting portion undergoes dissociation into protons on the first electrode for the determination of hydrogen. See the abstract and fig. 1 and 4. With respect to said sensor having a proton-conducting rate from the first electrode to the second electrode that is greater than a rate at which protons derived from hydrogen are introduced onto the electrode, that is inherent in diffusion limiting devices like JP '146. In particular, the sensor is disclosed as being a limiting current sensor and limiting current sensors rely on the use of the diffusion hole 4 to limit the gas flow to the sensor electrode. This is further evidenced by Logothetis, which teaches that diffusion limited sensors have a complete depletion of gas at the surface of the sensing electrode. See the paragraph bridging pp. 141 and 143 and fig. 3b, which uses a diffusion hole, like that of JP '146, to cause the current limiting behavior. The reason that the gas is completely depleted at the sensing electrode surface is because the rate of sensing gas flow to the sensing electrode is less than the ability of the sensor to transmit the dissociated gas

through the electrolyte. In other words, the rate at which sensing gas ions can transmit from the first electrode to the second electrode is greater than the rate at which gas can be made available to the sensing electrode.

15. JP '146 does not explicitly disclose the use of a polymer based proton electrolyte. However, Yamazoe teaches that there are a number of suitable materials usable as electrolytes for hydrogen gas sensors including both ceramic based components, like those of JP '146, as well as polymers such as Nafion (col. 4, lines 10-30). Polymers like Nafion can be utilized at temperatures near or at room temperature (see Yamazoe col. 9, lines 15-24). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Yamazoe for the sensor of JP '146 in order to increase the utility of the sensor to lower temperature applications. Furthermore, the teaching of JP '146 was concerned about limiting the contribution of oxygen to the hydrogen measurement signal (the electrolyte of JP '146 is conductive to both proton and oxygen ions and JP '146 does not desire the oxygen ion contribution). Hence, it would have been further obvious to one of ordinary skill in the art that a polymer electrolyte like Nafion, because Nafion is not appreciably conductive to oxygen ions.

16. Claim 26 (and claim 25 in the alternative) is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '146 in view of Yamazoe as applied to claim 25 above, and further in view of Joshi et al (USP 6,051,123).

17. With respect to claim 26, the references set forth all the limitations of the claim, but did not explicitly the use of opening diameter of 30 μm or higher. Joshi discloses that diffusion holes for gas sensors are typically less than 120 μm. See col. 10, ll. 5-21. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the

teaching of Joshi for the sensor of JP '146 and Yamazoe because the use of standard diffusion openings requires only routine skill in the art.

18. With respect to claim 25 in the alternative, even if the "microhole" of JP '146 were not interpreted as anticipating a hole greater than 1 μm, then claim 25 would then be further obvious over the teaching of Joshi.

19. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nadanami in view of either JP '592 or JP '146 and Shen et al (USP 5,573,648).

20. With respect to claims 27 and 28 (those limitations not covered above), Nadanami also teaches an embodiment having a reference electrode 28 formed on the polymer electrolyte. See fig. 4 and col. 8, ll. 1-18. However, Nadanami did not teach placing this reference electrode on the same surface as the second electrode. Shen teaches in an alternate Nafion based sensor that it is conventional to include the reference electrode 15 on the same side as the counter (or second) electrode and the opposite side as the sensing (or first) electrode 16. See fig. 11 and col. 10, ll. 23-54. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to place the reference electrode on surface opposite the sensing electrode when modifying Nadanami for use with opposing electrode, as taught by Shen, because reference electrode 28 has to be in a different gas space from that of first electrode 23 (otherwise no potential difference would be possible between electrodes 23 and 28).

21. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '146 in view of Yamazoe and Shen with or without the further teaching of Joshi as applied to claims 25 and 26 above, and further in view of Shen and Bard & Faulkner (Electrochemical Methods, 1980, pp. 22-26) (hereafter referred to as "Bard").

22. The references set forth all the limitations of claim 27 and 28 (see rejections above), but did not explicitly recite the presence of a reference electrode on the same side of the polymer electrolyte as the second electrode. Shen teaches in an alternate Nafion based sensor that it is conventional to include a reference electrode 15 on the same side as the counter (or second) electrode and the opposite side as the sensing (or first) electrode 16. See fig. 11 and col. 10, ll. 23-54. Although Shen did not specify the advantage of adding the third electrode, Bard teaches that the three-electrode cell is less susceptible to the internal resistance of the sensor (p. 23, lines 13-20). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Bard and Shen for the sensor of JP '146 and Yamazoe (with or without Joshi) in order to construct a sensor less susceptible to internal resistance of the electrolyte.

Allowable Subject Matter

23. Pending resolution of the double patenting rejection, claims 29 and 30 would be allowed.

24. The following is a statement of reasons for the indication of allowable subject matter: The prior art does not disclose nor render obvious all the cumulative limitations of these claims with particular attention to a sensor having a diffusion-rate limiting portion set such that current (a) is greater than current (b) during the conditions defined in the claims for currents (a) and (b).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kaj Olsen whose telephone number is (571) 272-1344. The examiner can normally be reached on Monday through Friday from 8:00 A.M. to 4:30 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen, can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AU 1753
December 21, 2006

KAJ K. OLSEN
PRIMARY EXAMINER